WALLCOLMONOY
SURFACING ALLOYS

WALLCOLMONOY CORP. (USA)
TECHNICAL DATA SHEET

Pump Sleeve - a typical Colmonoy 72 application.

Colmonoy® 72 Alloys:
(72, 72M, 72PTA, 72L)

Nickel-Based Hard-Surfacing Alloys That Provide Excellent Resistance to High-Stress Abrasion

Description:

Colmonoy 72 alloys include 72, 72M, 72PTA, and 72L. They are a variant of Colmonoy 88, containing less chromium and tungsten. They provide excellent resistance to high-stress abrasion. Colmonoy 72 alloys tungsten content provides resistance to fretting corrosion at elevated temperatures.

Colmonoy 72 alloys are spray deposited and fused to achieve a hardness range of **Rockwell C 57-62**. The presence of chromium carbide crystals (2500 DPH) gives these alloys excellent abrasion resistance, far greater than Rockwell hardness tests indicate because such tests measure only the hardness of the matrix, which is much softer than the crystals.

Applications include valve seats, pump parts, and other high-temperature service parts subject to low-stress abrasion and scouring actions. Colmonoy 72 alloys are also used in a variety of non-core Nuclear applications.

Nominal Composition - % by Weight:

B	C	Cr	Fe	Si	W	Ni
3.2	0.5	12.0	4.0	3.0	13.0	Bal

Forms Available:

Colmonoy 72 alloys are supplied as atomized powder for application with Wall Colmonoy's Spraywelder™ System, and other commercially available thermal spray, PTA and laser cladding systems. Ingot is also available.

Alloy	Mesh Size	Application
Colmonoy 72	140 mesh - 500 mesh	Spray-n-Fuse
Colmonoy 72M	120 mesh - 325 mesh	
Colmonoy 72PTA	100 mesh - 325 mesh	PTA
Colmonoy 72L	100 mesh - 325 mesh	Laser Cladding

Colmonoy 72, 72M:

Colmonoy 72 and 72M are designed for spray and fuse applications, using combustion thermal spray systems such as the J-3 Spraywelder and Fusewelder.

Fused coatings form a metallurgical bond with the substrate providing inter-particle cohesive strength and substrate-to-coating adhesive strength with very low porosity. The coatings show good resistance to wear and impact and their hot hardness is excellent. (Table 2)

Colmonoy 72M is designed for use with thermal spray systems that are more oxidizing, thereby requiring a coarser material to achieve a quality coating.

Properties:

Table 1: Physical Properties (approximate):

Specific Gravity	8.5
Melting Point	1940°F (1060°C)

Table 2: Room & Elevated Temp. Hardness:
Deposits produced by Spray-n-Fuse

Test Temp (°F / °C)	Rockwell C Hardness
70 / 21	57-62
600 / 315	62
800 / 425	62
1000 / 540	56
1200 / 650	41

Application Methods:

Colmonoy 72 alloys are easily applied to all steels having less than .25% carbon, gray cast iron; Meehanite, malleable, ingot and wrought iron; nickel, Monel[a] alloy 400, Inconel[a] alloy 600, Nichrome, Chromel[b]. Most high-temperature alloys can be overlaid without special precautions.

Steel having more than .25% carbon can also be overlaid, but requires controlled slow cooling after fusion, in suitable insulation such as Sil-O-Cel, mica, etc. Do not apply to ferrous metals that require subsequent hardening and tempering, because the dimensional change associated with the formation of martensite will crack the deposits of Colmonoy 72. Hardenable base metals may be overlayed, but must be annealed isothermally after uniform austenitizing to prevent cracking of the deposits of Colmonoy 72. (Consult Technical Services for further details).

Application by Spraywelder:

Colmonoy 72 and 72M powder alloys are applied by use of the Spraywelder System, which is the recommended Thermal Spray system designed by Wall Colmonoy to produce dense coatings. The powder is sprayed on the part to be hard surfaced as in ordinary metal spraying procedure, and the overlay is then fused to the base metal by torch, induction or furnace. This is ideal when deposits of uniform thickness are being applied over a large area. Reference Spraywelder Brochure and Manual for more information.

Application by Fusewelder:

Colmonoy 72 powder is applied by Fusewelder or similar torch. The Fuseweld™ Process is a coating application method to apply metallurgically bonded coatings to the edges and corners of molds and blanks. Small shafts, the leading edge of flights for augers and centrifuge scrolls, keyways, splines, and cams can all be efficiently coated or rebuilt with this process.

Application by PTA Welding:

There are numerous Plasma Transferred Arc Welding systems on the market and a wide range of welding parameters can be used with Colmonoy 72PTA to produce excellent weld overlays.

Wall Colmonoy recommends that a pure argon plasma gas be used in combination with an argon-hydrogen shielding gas and an argon carrier gas.

Welding parameter settings will depend on the base metal, its thickness, geometry and metallurgical condition as well as the desired properties/geometry of the weld overlay and the type of PTA equipment being used.

Preheat and weld inter-pass temperature can affect the quality of the weld deposit and its wear properties.

Preheat Temperature by Class for steels

Class	Description	up to ½"	½" to 1"	1" to 2"	Interpass
10xx	C steels	100 – 600	100 – 700	100 – 800	200 – 700
13xx	Mn steels	350 – 500	400 – 600	450 – 700	450 – 600
23xx	Ni steels	200 – 400	200 – 500	300 – 700	300 – 600
31xx	Ni – Cr steels	200 – 600	300 – 700	400 – 900	>400
32xx	Ni – Cr steels	300 – 900	400 – 1000	500 – 1100	500 – 900
33xx	Ni – Cr steels	500 – 900	600 – 1000	700 – 1100	700 – 900
34xx	Ni – Cr steels	900 – 1100	900 – 1100	900 – 1100	900 – 1100
4140	Cr – Mo steel	600	700	800	600 – 800
4340		600	800	900	700 – 900
46xx		400 – 600	500 – 700	600 – 800	≅ 600
4820		600	700	800	600 – 800
5120		100 min	200 – 300	250 – 350	≅ 300
5145		400 – 500	450 – 550	500 – 600	≅ 500
86xx		100 – 400	200 – 500	300 – 600	≅ 400
High strength alloy steels (quenched and tempered)					
A533, B		50 – 200	100 – 350	200 – 450	100 – 350
A542		150 – 300	200 – 350	250 – 450	200 – 350
HY-130		75 – 225	75 – 275	200 – 375	200 – 350

Application by Laser Cladding:

Laser Cladding utilizes a laser beam as a heat source to weld a surfacing material to a substrate. Surface cladding powder is delivered to the weld

zone through a powder feeder with an inert gas carrier. The power level of the laser, the powder feed rate, pre-heat of the base metal, and 3-dimensional movement speeds must be balanced to produce a metallurgically bonded, low dilution, crack free, porosity free clad overlay.

Properly applied laser clad overlays can have significantly higher hardness than a corresponding thermal spray applied coating of the same material. Alloy selection for the laser cladding process should take this into consideration.

Laser Cladding can be conducted in a sealed, inert environment, or in an open shop environment. In the latter case, the use of argon or helium carrier gases with argon and/or helium shielding gases are recommended. Nitrogen is not an inert gas and it is not recommended for general use in Laser Cladding.

Machining, Grinding and Lapping:

There are several techniques used for material removal that produce high quality finished products.

Machining can be done, using cubic boron nitride tooling. Use GE's BZN compacts (such as BRNG-43T) or Kennametal's CNMA 433KC-210. Use a negative rake tool, with a 15-degree lead angle. It should have a 3/64-in. radius and T-land edge preparation. Set tool at centerline of work. Feed at 0.005-0.010 IPR, with depth of cut up to 0.125-in., at 200-300 SFM or higher.

The coatings can be machined with difficulty by carbide-tipped tools, such as Kennametal K6, Carboloy 883 or equivalent. For roughing, grind the tool with a slight lead and rake angle, and a slight radius (approx. 1/32"). Use a fine feed, about 0.003" per revolution, with a depth of cut about 0.015" at 15 SFPM. Set tool about 1/32" below center. For finishing, grind the tool with the same slight lead and rake angles and with about a 1/16" radius. Use a fine feed, about 0.003" per revolution, with a maximum cut of 0.005" at approximately 45 SFPM.

Grinding is used after machining to remove the last 0.005-0.006" of material. Actually, the entire finishing is most commonly done by grinding, which eliminates machining. Grinding produces a near-frictionless mirror finish. Such smooth surfaces usually wear better, because they generate less heat and friction. Whereas a diamond wheel is preferred, green silicon carbide wheels (hardness H to K) can be used. Use 24 to 36 grit for roughing and 60 grit or finer for finishing. Grind wet when possible; do not let the wheel get loaded; dress frequently. Take light, fast cuts. (Manufacturer can provide full details for grinding.)

Dry lapping can be used to give the alloy an excellent finish. Silicon carbide, boron carbide and diamond dust are all capable of cutting the Colmonoy coating, but they must be embedded in a cast iron or steel wheel to properly lap fused deposits of Colmonoy 72 alloys. Apply with a steady pressure and avoid overheating. If the lapping compounds are used loose, they will cut the nickel matrix before the chromium carbides, giving the surface an etched appearance.

Safety:

When handling powders do so in such a way to avoid creating a dust cloud; avoid inhalation or contact with skin or eyes. Conduct coating operations in a properly ventilated area. For more information, consult 11.8 (Ventilation), *AWS Thermal Spraying: Practice, Theory, and Application* available from American Welding Society, OSHA Safety and Health Standards available from U.S. Government Printing Office, and the manufacturer's Material Safety Data Sheet (MSDS).

Warning: Thermal spray torches and heating torches used for application of this product utilize compressed gases including oxygen and a flammable fuel gas. Follow your employer's safety procedures when using and handling these gases and equipment. Infrared and ultraviolet radiation (light) emitted from flame and hot metal can injure eyes and burn skin. Use appropriate personal protective equipment.

Danger: Plasma transferred arc (PTA) welding is a welding process used for application of this product. Follow your employer's safety procedures and the equipment manufacturer's instructions when PTA welding. Electric shock can kill. Properly install and ground electrical equipment prior to use. Infrared and ultraviolet radiation emitted from the hot metal or welding arc can injure eyes and burn skin. Use appropriate personal protective equipment.

Warning: Laser cladding processes may use high power levels when applying this product. Follow your employer's safety procedures and the equipment manufacturer's instructions when laser cladding. Refer to AISI Z136.1 "Safe use of Lasers" and consult your employer's Laser Safety Officer regarding the proper use of personal protective equipment.

Storage Requirements:

Keep thermal spray powders in a closed container and protect against moisture pick-up. The containers should be tumbled before using the powder. If moisture is absorbed from the atmosphere, it can be removed and flowability can be restored by drying the powder, with the seal removed and lid loosened, at 150-200°F (66-93°C) for two hours prior to use.

The information provided herein is given as a guideline to follow. It is the responsibility of the end user to establish the process information most suitable for their specific application(s). Wall Colmonoy Corporation (USA) assumes no responsibility for failure due to misuse or improper application of this product, or for any incidental damages arising out of the use of this material.

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